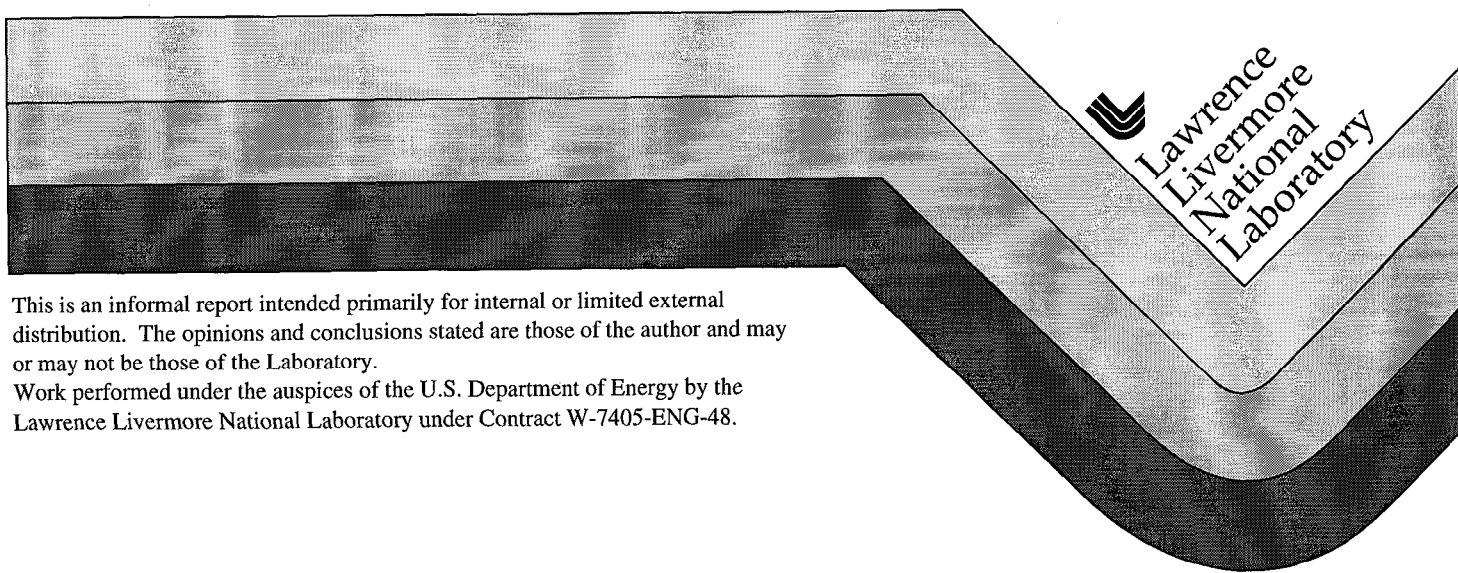


User-Calibration of Mettler AT200 Analytical Balance

J. Estill

July 2, 1996



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YUCCA MOUNTAIN PROJECT

Technical Implementing Procedure

No.: TIP-CM-04

Revision: 0

Effective Date:

Page: 1 of 5

Subject:

User-Calibration of Mettler AT200 Analytical Balance

AUTHOR:

J. Estill

Training Required: Yes ☒ No ☐

Comments:

Training required for personnel performing work to this TIP.

REVISION HISTORY

<u>Rev. No.</u>	<u>CN No.</u>	<u>Effective Date</u>	<u>Description of Revision/CN</u>
0		07/02/96	Initial Issue

Approved by:

William E. Talley
CRWMS LLNL Manager

ACTING TOO
W.L. CLARKE

7/2/96

Date

Approved by:

Boyle M. Smith
M&O LLNL Quality Assurance Manager

7-2-96

Date

Approved by:

R. Daniel McCarty
Technical Area Leader

July 2, 1996

Date

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1.0 PURPOSE

The purpose of this technical implementing procedure (TIP) is to describe the calibration of the Mettler AT200 analytical balance or similar type balance (henceforth called the 'balance'). This balance is used for activities of the Scientific Investigation Plan (SIP) "Metal Barrier Selection and Testing" (SIP-CM-01, WBS # 1.2.2.5.1). In particular, it will be used for Activity E-20-50, "Long-Term Corrosion Studies." The balance will be used for weighing test specimens and reagent chemicals. However, it is not limited to these uses.

The calibration procedures consist of activating the internal (self) calibration of the apparatus, and weighing and recording of traceable standards. The balance is equipped with self (internal) calibration and linearization capabilities. It has an internal (built in) set of weights which are used for self calibration. The standard weights are traceable to National Institute of Standards and Technology (NIST).

2.0 SCOPE

This procedure describes the methodology for calibration of a Mettler AT200 analytical balance or similar type balance. NIST traceable weights are employed in the calibration procedure.

3.0 RESPONSIBILITIES

The Principal Investigator (PI) or designee is responsible for the conduct of the activities and methods described in this procedure, and maintaining scientific notebooks and/or electronic recording media.

The Technical Area Leader (TAL) is responsible for verifying that this procedure meets the objectives of SIP "Metal Barrier Selection and Testing" (SIP-CM-01, WBS # 1.2.2.5.1), and the Activity Plan for E-20-50, "Long-Term Corrosion Studies."

The YMP Quality Assurance Manager is responsible for monitoring the implementation of this TIP and for assuring the continuing effectiveness of the applicable controls.

4.0 EQUIPMENT

- A. Analytical Balance Mettler AT200 Serial # 1114463500 or similar type balance. A copy of the operating manual will be maintained with the balance.
- B. NIST traceable weights Troemner Weight Set (no serial number) 0.005 grams to 100 grams. Certified by Sandia National Laboratories, Standards Laboratory Certificate. Recall No. 4935818, date tested: June 13, 1996, expires on June 13, 1999. (see Appendix)

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5.0 ANALYTICAL BALANCE OPERATIONS

Note: A schematic of the balance is shown in Exhibit 1, with features of the balance labeled numerically. The numbered features referred to in the following paragraphs will be in *italics*.

- A. Turning on balance: depress key 1 "Re-Zero", "Set", "On/Off". (The balance must warm up for at least 5 minutes if starting from a cold start before proceeding to any other operation.)
- B. Leveling of balance: adjust the two screw feet 24 at the rear of the balance housing so that the air bubble is in the middle of level 17

6.0 FREQUENCY OF CALIBRATION

- A. Calibration shall be performed on the day the specimens are weighed.
- B. Different users shall calibrate the balance and shall not rely on the calibration of others.

7.0 CALIBRATION PROCEDURES

The calibration procedures follow those recommended by the manufacturer [Mettler, 1994].

7.1 Record traceable standards information

Record certified weights, including tolerances, of the standards used in the calibration. Also include certification numbers, the standards laboratory, and any other pertinent information. Note that once this information is entered into a particular scientific notebook or specific electronic database it does not need to be re-entered each time the balance is calibrated.

7.2 Initial calibration

- A. Turn on the balance.
- B. Ensure that the balance is levelled.
- C. Activate the balance to perform its self calibration.
 - 1) Repeatedly press the "Menu" key 3 until "AUTOCAL; CAL int" appears on the display 25 and 26.
 - 2) Trigger the calibration procedure by pressing the "Set" key 1. Ensure that the draft shield 8 is closed.

The balance signals the user that the calibration and linearization are complete when "CAL End" appears in the display 25 and the beep sounds. The balance returns to the weighing mode at this time.

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- D. Weigh certified weight(s) in the balance. The weights are chosen to encompass the nominal weights of the specimens to be weighed.
- 1) Zero the balance by pressing the "Re-Zero" key 1. The draft shield closes and the balance zero itself. The balance beeps, and then the draft shield opens when zeroing is complete.
 - 2) Load the weights, close draft shield 8, and press the "Print" key 6. When the weighing is complete a beep sounds, the draft shield opens, and the weight is displayed for 5 seconds.
 - 3) If the balance is connected electronically to computer, pressing the "Print" key 6 will also activate data transfer. If the balance is not connected to a computer, the user will record the readings in the scientific notebook.

7.3 In process recalibration of the balance.

The balance has the feature that it will calibrate and linearize itself as soon as it detects a change in the local conditions which warrants recalibration. The unit notifies the user that the recalibration is required when "AUTOCALIN" appears in the display 25. When this occurs, the user will terminate what he/she is doing, and will perform the following recalibration procedure.

Activate the balance to perform its self calibration by

- A. Repeatedly pressing the "Menu" key 3 until "AUTOCAL; CAL int" appears on the display 25 & 26.
- B. Triggering the calibration procedure by pressing the "Set" key 1. Ensure that the draft shield 8 is closed.

The balance signals the user that the calibration and linearization are complete when "CAL End" appears in the display 25 and the beep sounds. The balance returns to the weighing mode at this time.

7.4 Recording of traceable weight standards at completion of task.

At the completion of a task or portion of a task, measurement of the same weights used in step 7.2(D) will be repeated and recorded in the appropriate file of an electronic database or the scientific notebook.

8.0 OUT OF CALIBRATION

Out of calibration equipment will be handled as specified by QP 12.0, "Control of Measuring and Test Equipment". If the absolute weights of standards differ by more than $\pm 0.001\text{g}$ from the readings of the balance, then the balance cannot be used for this activity until it is repaired and reads within the acceptable range.

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If there is a drift of the weight readings of the standard weights of more than $\pm 0.001\text{g}$, then the unit can not be used in this activity.

9.0 TRAINING

Personnel responsible for the measurement of test specimens in the applicable activities of SIP "Metal Barrier Selection and Testing" (SIP-CM-01, WBS # 1.2.2.5.1) shall be trained to this TIP. In particular, this TIP applies to Activity E-20-50, "Long-Term Corrosion Studies."

10.0 QUALITY ASSURANCE RECORDS

The following are retained as Quality Assurance records:

- scientific notebook and/or an electronic database (e.g. Microsoft Access)
- the calibration certificates of the NIST traceable standards
- any Nonconformance Reports resulting from calibration

Calibration records governed by this TIP shall be maintained in the scientific notebook and/or appropriate electronic media.

11.0 ASSOCIATED ACTIVITIES AND TIPS

This TIP can be used in the activities of the of SIP "Metal Barrier Selection and Testing" (SIP-CM-01, WBS # 1.2.2.5.1). In particular it may be used in

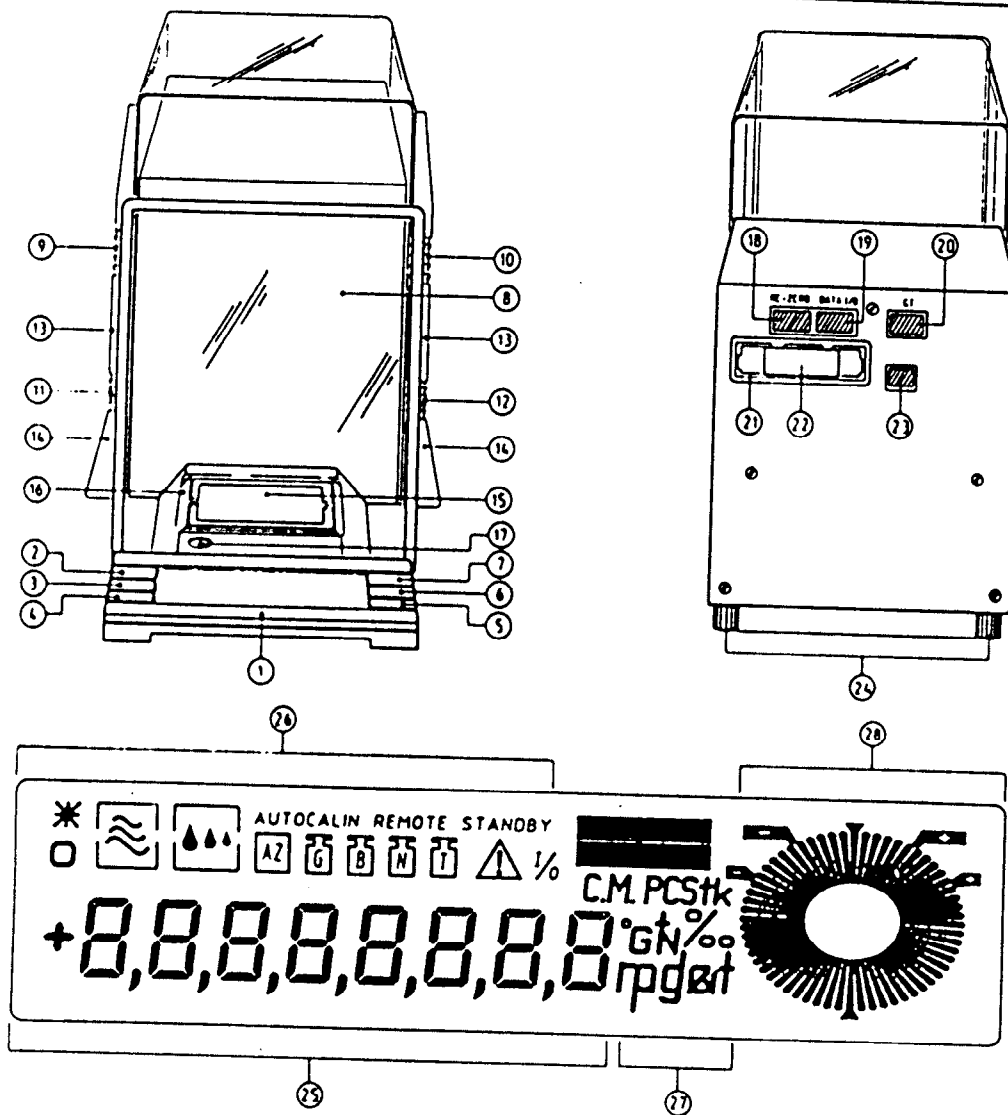
- Activity E-20-50, "Long Term Corrosion Studies"
- Activity E-20-47, "Thermogravimetric Studies"

Associated TIPs include:

- TIP-CM-03, "Electronic Weight-and-Dimensional-Data Entry in a Computer Database"
- TIP-CM-05, "User-Calibration of Fowler Ultra-Cal Mark III Digital Caliper"

12.0 APPENDIX

Standards laboratory certificate for metric weights.



- 1 Key «Re-Zero», «Set», «On/Off»
- 2 Key «0.1/0.01 mg» (with dual-range balances only), «Cancel»
- 3 Key «Menu», «Configuration»
- 4 Key \uparrow «Select 1»
- 5 Key \downarrow «Select 2»
- 6 Key «Print»
- 7 Key ∞
- 8 Glass draft shield
- 9 Coupling element
- 10 Coupling element
- 11 Coupling element
- 12 Coupling element
- 13 Door handle
- 14 Door drive handle
- 15 Weighing pan
- 16 Draft cover
- 17 Level
- 18 Connection for foot or hand switch and electrical contacts
- 19 Connection for data interface
- 20 Connection for METTLER GT units
- 21 Plug-in slot for program cassette
- 22 Program cassette
- 23 Connection for AC adapter
- 24 Screw feet
- 25 Digital display (VFD or LCD)
- 26 Status indicators
- 27 Weight units
- 28 METTLER DeltaTrac

Standards Laboratory Certificate

METRIC WEIGHTS (Set of 18)

Manufacturer: Troemner

Range: .005 grams to 100 grams

Tested for: LLNL

Date tested: June 13, 1996

Expires on: June 13, 1999

Recall No.: 4935818

Serial No.: None

The weights identified above were tested to determine the individual mass values only. The values under the heading "Apparent Mass vs. Steel" on the attached page are those that the weights would appear to have when compared in an air density of 1.180 mg/cm³ (San Francisco average) against stainless steel standards (material density 8.0 g/cm³). The average air density is based on information about the barometric pressure and relative humidity provided by the National Weather Service. The estimated average air density may differ by +/- 3 % from the actual air density. Actual temperature, barometric pressure, and humidity were measured and used in the true mass calculations. "True Mass" values are those that the weights would appear to have in air of zero density, i.e., in a vacuum.

This weight set is expected to remain within the estimated uncertainties listed on the attached page for the duration of the certification interval provided it is not physically damaged.



Certified by: Ken Conrad, 1486

Reference Standards:

<u>I.D. Number</u>	<u>Description</u>	<u>Expires</u>
7532P	Weight Set	04/20/97
T1090	Temperature	10/11/96
C4020	Humidity	08/09/96
AH04291	Pressure	01/01/97

Copy to:

Lawrence Livermore National Laboratory
P.O. Box 808
7000 East Ave.
Livermore, California 94550

Recall No.: 4935818

Expires on: June 13, 1999

Tested for: LLNL

Nominal	TRUE MASS		APPARENT MASS vs STEEL		Meas. Uncer.
	Value	Dev	Value	Dev	
100.00	99.99978	-0.22	99.99947	-0.53	0.50
50.00	50.00018	0.18	50.00003	0.03	0.20
20.000	20.000073	0.073	20.000013	0.013	0.06
20.000	20.000073	0.073	20.000013	0.013	0.06
10.000	10.000009	0.009	9.999978	-0.022	0.06
5.000	5.000032	0.032	5.000017	0.017	0.05
2.000	2.000029	0.029	2.000023	0.023	0.04
2.000	1.999994	-0.006	1.999988	-0.012	0.04
1.000	1.000002	0.002	0.999999	-0.001	0.04
0.500	0.499985	-0.015	0.499985	-0.015	0.03
0.200	0.199981	-0.019	0.199981	-0.019	0.03
0.200	0.199983	-0.017	0.199983	-0.017	0.03
0.100	0.099992	-0.008	0.099992	-0.008	0.01
0.050	0.049992	-0.008	0.049992	-0.008	0.01
0.020	0.020005	0.005	0.019999	-0.001	0.01
0.020	0.019989	-0.011	0.019983	-0.017	0.01
0.010	0.009996	-0.004	0.009993	-0.007	0.01
0.005	0.005008	0.008	0.005007	0.007	0.01

***** Values in Grams *****

* Deviations in Milligrams *

Material and Assumed Density:

Material	(g/cm3)	Range	
Stainless	7.84	1.000	100.000
Stainless	8.0	0.050	0.500
Aluminum	2.7	0.005	0.020

Apparent mass vs steel values were calculated using an air density of 1.18 mg/cm³ (San Francisco average) and true mass values were calculated using actual measured values for temperature, barometric pressure and humidity at time of test.